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XVI. *An Account of the Discovery of Two Satellites revolving round the Georgian Planet.* By William Herschel, LLD.
F. R. S.

Read Feb. 15, 1787.

THE great distance of the Georgian planet, and its present situation in a part of the zodiac which is scattered over with a multitude of small stars, has rendered it uncommonly difficult to determine whether, like Jupiter and Saturn, it be attended by satellites. In pursuit of this inquiry, having frequently directed large telescopes to this remote planet, and finding myself continually disappointed, I ascribed my failure to the want of sufficient light in the instruments I used; and, for a while, gave over the attempt.

In the beginning of last month, however, I was often surprised when I reviewed nebulae that had been seen in former *sweeps*, to find how much brighter they appeared, and with how much greater facility I saw them. The cause of it could be no other than the quantity of light that was gained by laying aside the small speculum, and introducing the *Front-view*; an account of which has been inserted, by way of note, to the Catalogue of Nebulae contained in the Philosophical Transactions, vol. LXXVI. p. 499.

It would not have been pardonable to neglect such an advantage, when there was a particular object in view, where an accession of light was of the utmost consequence; and I wondered

dered why it had not struck me sooner. The 11th of January, therefore, in the course of my general review of the heavens, I selected a *sweep* which led to the Georgian planet; and, while it passed the meridian, I perceived near its disk, and within a few of its diameters, some very faint stars whose places I noted down with great care.

The next day, when the planet returned to the meridian, I looked with a most scrutinizing eye for my small stars, and perceived that two of them were missing. Had I been less acquainted with optical deceptions, I should immediately have announced the existence of one or more satellites to our new planet; but it was necessary that I should have no doubts. The least haziness, otherwise imperceptible, may often obscure small stars; and I judged, therefore, that nothing less than a series of observations ought to satisfy me, in a case of this importance. To this end I noticed all the small stars that were near the planet the 14th, 17th, 18th, and 24th of January, and the 4th and 5th of February; and though, at the end of this time, I had no longer any doubt of the existence of at least one satellite, I thought it right to defer this communication till I could have an opportunity of seeing it actually in motion. Accordingly I began to pursue this satellite on Feb. the 7th, about six o'clock in the evening, and kept it in view till three in the morning on Feb. the 8th; at which time, on account of the situation of my house, which intercepts a view of part of the ecliptic, I was obliged to give over the chase: and during those nine hours I saw this satellite faithfully attend its primary planet, and at the same time keep on, in its own course, by describing a considerable arch of its proper orbit.

While I was chiefly attending to the motion of this satellite, I did not forget to follow another small star, which I was pretty

pretty well assured was also a satellite, especially as I had, on the night of the 14th of January, observed two small stars which were wanting the 17th, and again missed other two the 24th which had been noticed the 18th; but, whether owing to my great attention to the former satellite, or to the closeness of this latter, which was nearly hidden in the rays of the planet, I could not be well assured of its motion. Indeed, towards morning, when a change of place, in so considerable an interval as nine hours, would have been most conspicuous, the moon interfered with the faint light of this satellite, so that I could no longer perceive it.

The first moment that offered for continuing these observations was on February the 9th, when I saw my first discovered satellite nearly in the place where I expected to find it. I perceived also, that the next supposed satellite was not in the situation where I had left it on the 7th, and could now distinguish very plainly that it had advanced in its orbit, since that day, in the same direction with the other satellite, but at a quicker rate. Hence it is evident, that it moves in a more contracted orbit; and I shall therefore call it in future the first satellite, though last discovered, or rather last ascertained; since I do not doubt but that I saw them both, for the first time, on the same day, which was January the 11th, 1787.

I now directed all my attention to the first satellite, and had an opportunity to see it for about three hours and a quarter; during which time, as far as one might judge, it preserved its course. The interval which the cloudy weather had afforded was, however, rather too short for seeing its motion sufficiently, so that I deferred a final judgment till the 10th; and, in order to put my theory of these two satellites to a trial, I made a sketch on paper, to point out before-hand their
situation

situation with respect to the planet, and its parallel of declination.

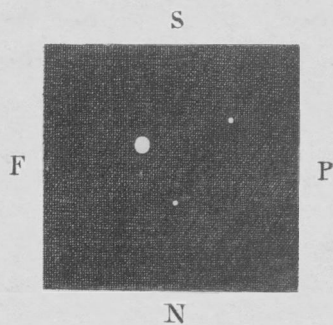
The long expected evening came on, and, notwithstanding the most unfavourable appearance of dark weather, it cleared up at last. And the heavens now displayed the original of my drawing, by shewing, in the situation I had delineated them, *The Georgian Planet attended by two Satellites.*

I confess that this scene appeared to me with additional beauty, as the little secondary planets seemed to give a dignity to the primary one, which raises it into a more conspicuous situation among the great bodies of our solar system.

For upwards of five hours I saw them go on together, each pursuing its own track; and I left them situated, about two o'clock in the morning on February the 11th, as they are represented in the figure, Tab. VII. The letters S, N, P, F, denote the south, north, preceding, and following parts of the heavens, as they are seen, by the *front-view*, in my telescope. The south preceding satellite is the second, or that whose motion was first ascertained; the other is that which moves in a smaller orbit, or what I have called the first satellite; and the direction of their motion is according to the order P, S, F, N, of the letters.

I have not seen them long enough to assign their periodical times with great accuracy; but suppose that the first performs a synodical revolution in about eight days and three-quarters, and the second in nearly thirteen days and an half.

Their orbits make a considerable angle with the ecliptic; but to assign the real quantity of this inclination, with many other particulars, will require a great deal of attention, and much contrivance: for, as estimations by the eye cannot but be extremely fallacious, I do not expect to give a good account of
their



their orbits till I can bring some of my micrometers to bear upon them ; which, these last nights, I have in vain attempted, their light being so feeble as not to suffer the least illumination, and that of the planet not being strong enough to render the small silk-worm's threads of my delicate micrometers visible. I have, nevertheless, several resources in view, and do not despair of succeeding pretty well in the end.

W. HERSCHEL.

Slough, near Windsor,
February 11, 1787.

